Geological Significance and Structural Evolution of the Major Geosructural Patterns of Taiwan During the Neogene Epoch (新第三紀における台湾の主要構造系の地質学的意義と構造発達史)

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学位の種類	理学博士
学位記番号	理第128号
学位授与年月日	昭和41年9月21日
学位授与の要件	学位規則第5条第2項該当
最終学歴	1936年7月 中国国立清華大学理学院地学系卒業
学位論文題目	Geological Significance and Structural Evolution of the Major Geostructural Patterns of Taiwan During the Neogene Epoch (新第三紀における台湾の主要構造系の地質学的意義と構造発達史)
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論 文 內 容 要 旨

Recent progress in the geology of Taiwan has resulted in the establishment of lithostratigraphical units of two major sedimentary groups, one of the northern half and the other of the southern half of Taiwan, their differences being characteristically unified by their respective sedimentary environments which are intimately associated with the stability of the foundation rocks, nature of the hinterland and growing influence of tectonism throughout out the Early Neogene to Late Quaternary ages. The sedimentary environments are those of geosynclinal or deepwater and thick sediments and shallow water neritic, lacustrine and terrestrial nature. The first mentioned one characterizes the southern half of Taiwan whereas the latter three are typical of the northern part of the island where coal beds are well developed. The lithogenetic source rocks of the sediments making up the lithostratigraphical units which comprise mainly arenaceous and argillaceous rocks, are of two major areas, one existing on the western side of Taiwan and the other partially on the eastern. The aforementioned phenomena are associated intimately with the evolutionary development of the tectonism already mentioned.

The lithostratigraphical units established in the northern half of Taiwan, in the order of younger to older, are as follows :

Toukoshan Formation, comprising two important lithofacies called Houyenshan Facies in the upper and the Hsiangshan Facies in the lower. Amounting to about 1,800 to 2,600 meters in total thickness.

Cholan Formation. Estimated at 1,400 to 2,300 meters in thickness.

Chinshui Shale. Measuring 300 meters in thickness, which changes at places.

Kueichulin Formation. From 800 to 1,800 meters in thickness.

Nanchuang Formation. From 500 to 1,350 meters in thickness and comprising two parts, the Shangfuchi Sandstone in the upper part and the Tungkeng Formation in the lower.

Nankang Formation. Measuring more than 1,300 meters in thickness and composed of three major lithological parts, the Kuangyinshan Sandstone in the upper, the Talu Shale in the middle and the Peiliao Formation

in the lower.

Shihti Formation. Estimated to be more than 450 meters in thickness.

Taliao Formation. Measuring about 400 meters in thickness,

Kungkuan Tuff. about 0 to 200 meters in thickness : thinning out at places.

Mushan Formation. Estimated to be 500 or more meters in thickness.

Wuchihshan Formation. more than 1,000 meters in thickness.

These formations are mostly of sandstones and shales or their alternation and underlain by pre-Neogene rocks, which have been referred in part to the Paleogene. Besides the above mentioned formations there are also developed some Igneous rocks, Volcanic debris, Terrace deposits, Lateritic deposits, Talus and Alluvium. However, only the Neogene and Quaternary units are described in the present work.

The arc of the Taiwan and adjacent Ryukyu Islands is of tectonic nature, and so far as Taiwan is considered, the structural lineage of the lithostratigraphical units was subjected to two major agencies, one is the primary arc and the other is the secondary arc, both of which are governed by geological phenomena, described in the original works as wrench fault and lateral movement and the abundant major thrust and or reverse faults are included. These are megageological features considered to have given birth to the geostructure of Taiwan through continuous evolution of tectonism since the Early Neogene. The movements continued into Late Quaternary and not only influenced but actually governed or controlled the geological and geomorphological developments of the geostructures and island configuration.

Lithological similarity, paleontological evidence of the planktonic and benthonic Foraminifera and shell-bearing Mollusca, structural trends of the major geostructures in the Philippine Islands and in Taiwan, as well as the configuration of the deep sea bottom offing Taiwan and western Philippines, including the structural lineation and construction of the deformed longitudinal area in the northern half of Taiwan, all point to, or at least strongly suggest, that lateral movement such as drifting of blocks northwards from the south and their coming into contact with the stable ones on the west or continental region resulted in the construction of the geostructure and configuration observed and preserved in the island of Taiwan.

The intense compressive forces acting upon the stable area by the laterally moved blocks from the south, represented by a major sole fault and metamorphic area, resulted in the construction of abundant reverse and thrust faults associated with less important normal faults. The north to south general trend of the faults mentioned above and their abrupt northeastward curvature at their northern parts is evidence of that the compressive forces were not merely lateral but also somewhat oblique to the stableland. Important is that the dips of the thrust and reverse faults gradually becomes less steeper westwards although sometimes nearly vertical or overturned at the eastward marginal areas. This characteristic feature cannot be overlooked because it may be taken as evidence of the intensity of the compressive forces and also indication of the direction of those forces.

It is important and necessary that an analysis and interpretation of the geological structures, their geological dates of occurrence and continuity, direction of compressive forces, configuration and construction of the foundation rocks and sea bottom offing the areas under consideration, and the characteristic features already mentioned above should be undertaken in order that the events leading to the construction and or destruction of the basement as well as later configuration, geostructures and stepby step island growth and other phenomena be understood as expressed in the present article.

論文審査結果の要旨

最近20年間，台湾においては石油探査の進展と相俟って，古生物学・生層位学・堆積学・地球物理学・地球化学等の基礎的研究が多大の成果を挙げている。

孟昭彝提出の論文は，これらにもとづく発表済の論文３篇を含め，台湾の新生代構造発達史をまとめたもので，序言・謝辞ならびに５章からなる。

第１章：台湾の地形・地質および構造を概説し，地表の精査と多数の試錐資料により新第三系および第四系の層序を述べている。

第２章：台湾の新第三系・第四系の堆積・構造発達ひいては石油鉱床の生成に支配的要因をなしたwrench fault tectonismについて述べている。台湾はその中央をほぼ南北に縦断する主要断層によって，地質学的に著るしい対照をなす東西２地塊に分けられる。東部地塊に主に変成岩から成り，フイリツピン，琉球群島との構造 ── 地形的関係・西部地塊の地質および構造の特異性から，これが南方からの移動地塊であることを推論している。これに対し西部は原地地塊であって，新第三系・第四系から成り，前者はその岩相・厚さの変化，特に鮮新統のそれらにもとづき支那大陸東縁の大陸棚から外海に亘る一連の地層と考えられ，その堆積環境の変遷・地質構造の特徴等により，西部地塊の地史が，東部地塊の北方水平移動に強く支配されたことを明かにしている。

第３章：台中盆地の東縁を限る銅羅断層と苗栗出磺坑背斜の南端を切る三叉断層につき詳細な地表および重力調査をもとに，両者が別個の断層でなく一連の衝上断層（三義断層）であることを解明している。さらに，その性格を詳述すると共に，成因的には，北西地域に存在する雁行状断層群の発達，通霄 ── 鉄砧山背斜の弯曲と同じであることを明かにし，東部地塊の北方移動に伴う側圧に帰している。

第４章：現在台湾北部に見られる地形および構造の特異性を挙げ，その発展が２期に分けられる新生代末期の造構運動によることを明らかにしている。第１期は苗栗東方地域の上昇に伴って堆積した，極めて厚く，大型の礫から成る更新世嶺嵙山層の分布から確認されたもので，著るしく北西に突出した構造弧を生じた。つぎに，東部地塊の北方ないし北西移動による二次的変形の結果，現在の構造を生じた時期を第２期とし，第１次構造弧の南・北両翼地域と中央部との構造的差異からこれを証明している。すなわち，東部地塊と境する主要縦断層に沿う狭長な地域では，全体に亘り二次的に著るしく圧縮・変形され，高角度の断層群で寸断された覆瓦構造帯が形成され，南・北両翼に当る地域では二次的変形のほかに重力滑動を生じたが，中央部の変形は軽微で，もとの構造をのこし，重力滑動を伴っていない。これは第１次構造弧中央部が著るしく北西突出していたため第２期造構運動の影響の少なかったことで説明している。

第５章：以上を総括し，台湾西部特にその北半部の地形・地質・複雑な地質構造が中新世初期から更新世末期に亘り，現世にもおよぶ連続的な造構運動に支配され，特に台湾東部を占める変成岩地塊の北方水平移動がその主要な要因であることを述べて結論としている。

以上本論文は地学のあらゆる分野に亘る広汎な資料をもとに台湾の複雑な地質構造の発達を明かにし，幾多の新知見を加えるとともに，東亜のみならず太平洋周縁の比較構造論上重要な資料を提供しており，他方台湾における石油探査上重要な指針を与えている。

参考論文5篇のうち3篇は地球物理・地球化学的研究であり，他の2篇は堆積・構造・石油地質に関するもので，いずれも本論文に関係のある重要なものである。

よって孟昭爽提出の論文は理学博士の学位論文として合格と認める。